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From: "Alan Schutz" <Alan@geophysical.com>
To: "John Reed" <jreed@fcc.gov>
Date: 8/15/01 11:58AM
Subject: GPR Test data

98-153

Dear John,

I have attached the independent test data referred to in our recent telecon.
It's fine to put it on the web.

Alan E. Schutz
Engineering Manager
Geophysical Survey Systems, Inc.
Tel 603-893-1109 Fax 603-889-3984
E-Mail: alan@geophysical.com
Website www.geophysical.com

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Geophysical Survey Systems, Inc.

13 Klein Drive - P.O. Box 97, North Salem, NH 03073-0097, U.S.A. / Telephone (603) 893-1109
Fax (603) 889-3984 website www.geophysical.com e-mail alan@geophysical.com

August 15, 2001

John A. Reed
Office of Engineering and Technology
Federal Communications Commission
445 12th St SW, Room 7-A140
Washington, D.C. 20554
jreed@fcc.gov

Dear John,

We are attaching two different emission test reports from independent testing houses on our Ground Penetrating Radars. The first is our compact HandyScan, which operates at a center frequency of 1 GHz, with a PRF of 50 KHz. Below is a photo, and attached is the report of a Japanese test house comparing it to FCC Part 15 Subpart B class B. This system is primarily used for locating the position and depth of reinforcing bars of various material, as well as other utilities such as electrical wiring.



The photo below shows our Interragator II, a GPR system that is sold through Vermeer Manufacturing Co. It operates at 200 KHz PRF with a center frequency of 300 MHz. The test for Emission standard EN50081-2:1993 is attached.

This system is used to locate buried utilities, primarily to prevent destroying them with trenching and horizontal drilling machines.



Best regards,

Alan E. Schutz
Engineering Manager
Geophysical Survey Systems, Inc.

COMPANY : 日本無線株式会社
MODEL NAME : RCU-7-
MODEL NO. : NJJ-85A
POWER : D. C. 7. 2A
TEMP : 20°C 34%
DESCRIPTION : 製造番号 : ED42434

REPORT NO. : 01031364-11
STANDARD : FCC Part15 Sub B
CLASS : B
DISTANCE : 3m
TEST MODE : 通常動作モード
ENGINEER : T. Nomura

LIMIT1 : FCC Part15 Subpart B Class B (3m)
LIMIT2 :

	FREQUENCY [MHz]	METER READING		FACTOR [dB]	FIELD STRENGTH		LIMITS [dBuV/m]	MARGIN VER. [dB]	MARGIN HOR. [dB]	MEMO
		VER. [dBuV]	HOR. [dBuV]		VER. [dBuV/m]	HOR. [dBuV/m]				
1	53.380	38.9		-14.9	24.0		40.0	16.0		
2	43.850	38.4		-12.0	26.4		40.0	13.6		
3	68.910	43.4	34.4	-17.8	25.6	16.6	40.0	14.4	23.4	
4	81.430	40.5		-17.3	23.2		40.0	16.8		
5	88.200	45.2	46.4	-16.1	29.1	30.3	43.5	14.4	13.2	BROAD NOISE
6	119.020	41.4	37.1	-11.0	30.4	26.1	43.5	13.1	17.4	
7	130.050	45.9	45.1	-9.8	36.1	35.3	43.5	7.4	8.2	
8	131.550	41.5	38.3	-9.7	31.8	28.6	43.5	11.7	14.9	
9	156.610	41.5	37.5	-7.5	34.0	30.0	43.5	9.5	13.5	
10	169.130	44.5	43.4	-6.7	37.8	36.7	43.5	5.7	6.8	
11	181.660	43.9	43.1	-6.0	37.9	37.1	43.5	5.6	6.4	
12	194.190	36.7	42.1	-5.2	31.5	36.9	43.5	12.0	6.6	
13	206.720	40.4	43.2	-4.9	35.5	38.3	43.5	8.0	5.2	
14	240.560	39.3	39.8	-5.1	34.2	34.7	46.0	11.8	11.3	
15	269.360	36.9	43.4	-3.5	33.4	39.9	46.0	12.6	6.1	
16	294.420	38.5	37.9	-1.5	37.0	36.4	46.0	9.0	9.6	
17	300.680	42.6	43.5	-6.8	35.8	36.7	46.0	10.2	9.3	
18	319.480	43.2	39.1	-6.1	37.1	33.0	46.0	8.9	13.0	
19	344.530	38.5	35.5	-5.4	33.1	30.1	46.0	12.9	15.9	
20	382.120	37.9	34.2	-4.3	33.6	29.9	46.0	12.4	16.1	
21	400.910	41.7	35.5	-3.8	37.9	31.7	46.0	8.1	14.3	
22	526.190	34.1	29.8	-1.6	32.5	28.2	46.0	13.5	17.8	
23	632.540	36.2	33.9	0.0	36.2	33.9	46.0	9.8	12.1	

対策 ①

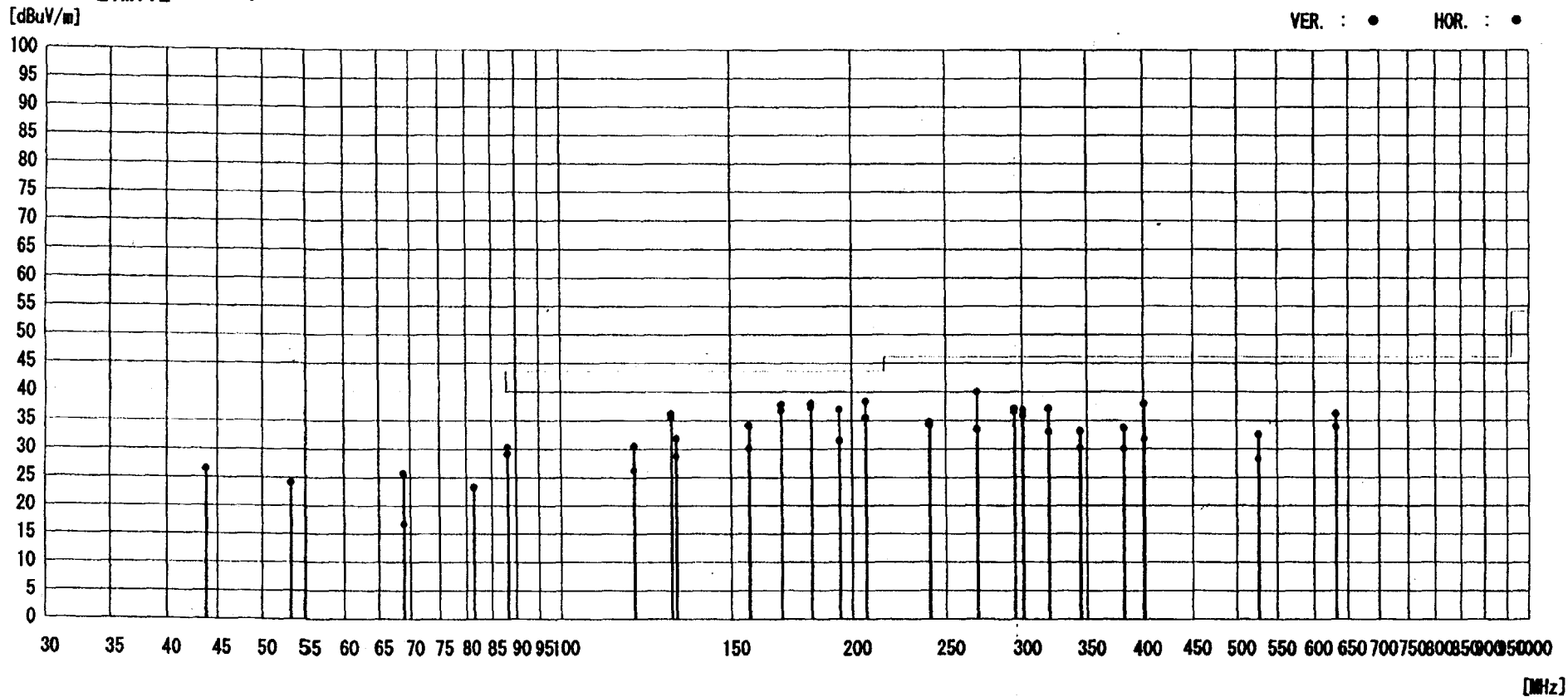
COMPANY : 日本無線株式会社
MODEL NAME : RCU-7
MODEL NO. : NJJ-85A
POWER : D.C. 7.2A

TEMP : 20°C 34%
DESCRIPTION : 製造番号 : ED42434

LIMIT1 : FCC Part15 Subpart B Class B (3m)
LIMIT2 :

REPORT NO. : 01031364-11
STANDARD : FCC Part15 Sub B
CLASS : B
DISTANCE : 3m
TEST MODE : 通常動作モード
ENGINEER : T. Nomura

対策 ①





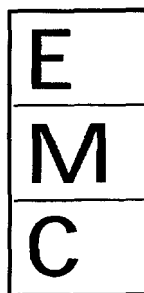
ce-test

PO-Box 563
2600 AN Delft The Netherlands
Caracasstraat 36
2622 BT Delft The Netherlands

tel. +31 15 257 29 74
fax +31 15 257 20 84

Chamber of Commerce Haaglanden 272 21907

E-mail ce-test@ce-test.nl
Web <http://www.ce-test.nl>



Electro

Magnetic

Compatibility

Test Report

Vermeer International BV

**GPR System
INTERROGATOR II**

Valid only with **ce-test** stamp
below

Electro Magnetic Compatibility of Electrical- and Electronic Equipment.

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INTRODUCTION

This report contains the result of tests performed by **ce-test** for the purpose of a type approval for :

Name	Vermeer International BV
Address	Postbus 323
Post code	4458 AV
City/Town	's-Heer Arendskerke
Country	The Netherlands
Date	13 jan 2001
References	Dhr. Leonard Huissoon

Manufacturer

Name:	Vermeer MC
Address	PO BOX 200 Pella, IOWA 50219 United States of America Mr. Gary Young

Product

A sample of the following product was submitted for testing:

GPR System

Environment	Industrial
Manufacturer	Vermeer Manufacturing Company (IOWA-USA)
Trade mark	Vermeer
Type designation	INTERROGATOR II

Parts contained in the product are:

Type designations	INTERROGATOR II
Description	GPR System
Serial numbers	00047

This report is modeled after the European standards EN 45001 and the ISO/IEC directive 25. The consecutive numbering of the pages as required by these standards, has been stated in the upper left corner of each page, together with the report number. The contents of this report , if reproduced, shall be copied in full, unless special consent in writing for reproduction in part has been granted by **ce-test**.
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PRODUCT SPECIFICATION

The Interrogator II is an Vermeer OEM product, partially build by GSSI. Confidentiality of the INTERROGATOR II concept is GSSI's main concern. Therefore no circuit diagrams and other specifications will be available for ce-test and Vermeer.

To reliably describe the version and revision of the Interrogator II, and to be able to compare future data found with this test report, detailed pictures are made available by GSSI and have been verified by ce-test.

As this is the only internal information available, this information has to be carefully compared to any product sample in the field in order to establish the validity of this test report.

GSSI is ready however, to handle over to a third party, such as a notified body the required further documentation, upon request and after signing a suitable non-disclosure agreement.

The Interrogator II is made up of readily available components of which one is the "antenna 30 Mhz" made by GSSI. It's this component that is further documented in the appendix using pictures.

This specification is enumerated below:

Component	Manufacturer	Type designation	Serial number	Accred
Touchbook	Panasonic	CF-27	OJKSA02046	CE/TUV
Cart Frame	GSSI	A70-368	000044	
Antenna 30 Mhz	GSSI	300-MC	000047	
Batterij	Powersonic	PS121-80F	-	
Network card	Linksys	10/100 PC	942902	
Automobile adapter	Panasonic	PA1540-201A		CE/TUV
Wheel sensor	Accu-coder	260-N2T-11-1000-0-0C	889168	

The touchbook is a Notebook PC compatible printer mounted on top of the Interrogator II chariot. It's pupose is to process raw date processed by the antenna box and transm,itted via the network to the touchbook.

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**PRODUCT DOCUMENTATION:**

For the production of this report the following product documentation was used:

Description:	Date:	Identification:	Sheets:
Operator manual	3-2000	01_00	114 odd
Specification sheet	none	none	2LETTER

This documentation is available at the end of this test report.

The tests have been carried out in conformance with the following:

Standard: EN 50082-2:1995 harmonized
 EN 50081-2:1993 harmonized

Emission standard EN 50081-2:1993
Immunity standard EN 50082-2:1995

The equipment has been classified as industrial equipment.

The emission testing was not in compliance with the test set up as described in CISPR document 22 . The reasons for this deviation -that leads to a Notified body involvement- are explained later in this test report.

The following tests from standards or parts of standards have not been fully carried out because of failure of the product:

None

The following tests from standards or parts of standards have not been fully carried out because of other reasons:

Test specification	Reason for exclusion	Remarks
EN 50081-2: MAINS	No mains connection	
EN 50082-2:1.3	No magnetic susceptible components	
EN 50082-2:2.1	No cables longer then 3 meters	Note 3.
EN 50082-2: 3.x	No process control cables	
EN 50082-2: 4.x	No DC-supply port	Note 3
EN 50082-2: 5.x	No mains port	
EN 50082-2: 6.1	No ground port	

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TEST PLAN

The Interrogator II is a ground penetrating "Radar" system. A considerable amount of energy is transferred into the ground by a suitable antenna. This antenna is shielded at all sides but the soil direction.

Therefore it could be classified as an intentional radiator. During analysis of the waveforms and spectrum of the transmitted waveforms, no transmitter suitable parameters such as carrier frequency and modulation type could be established, which makes compliance with any harmonized standard virtually impossible.

The pulse parameters of the transmit system are as follows:

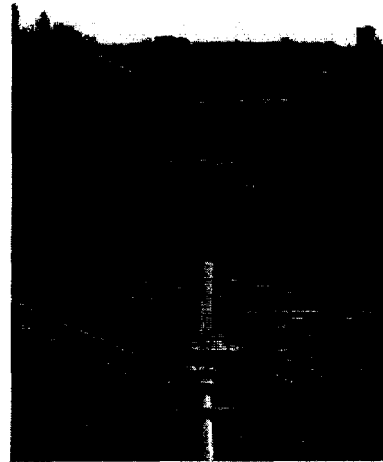
Repeat frequency :	200 KHz
Pulse width :	3 nS
Duty Cycle	< 0.1 %
Send power level	1 Watt (as specified by manufacturer)
Send spectrum	essential wide band (70 MHz to 560 MHz approx)

As the actual emitted level of energy did not interfere with any receiver, an approach was made to have the Interrogator II pass standard EMC emission requirements according to the EMC-directive, and not classifying the Interrogator II as an intentional radiator. When the system was tested on an OATS measurement area the spectrum of the exceeded the industrial emission limits with more the 10 dB (over 51 dBuV/m at 10 meters). According to GSSI this was due to the reflection of the metal ground plane that inhibited the transmitted energy to protrude the ground.

Therefore we have decided to deviate from the OATS emission testing concept by measuring the actual emission levels on a representative operating situation being a standard road (see picture).

The emission levels were much less as the energy is absorbed by the soil. Using this way of testing the emission levels exceeded the house-hold levels of 30dBuV/m at a frequency of 114 MHz with 4 dB only.

This approach deviated from the test methods as described in the harmonized standards as specified in this test report. Therefore a "statement of opinion" from a notified body is required for this product to obtain permission to use the ce-mark. This Statement of Opinion is part of the Technical Construction Files according to article 10.2 of directive 89/336/EC, and this test report and compliance declaration alone may not be used without consulting such a Statement of Opinion.



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TEST SCHEDULE

Tests have been carried out according to the specifications as described in the applicable standards at the following date's :

March	OATS measurements result in fail.
May 2001	2th initial measurements to determine outdoor results
May 30th	measurements using 100 Khz rep. rate
June 2001	19th Final emission measurements 200 Khz rep. rate

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FAILURE TO COMPLY:

NONE

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RETESTING

Several re-testing session were required to establish the final test situation replacing the OATS metallic groundplane by a real life soil.

No product modifications were introduced however.

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OBSERVATIONS AND COMMENTS

The Interrogator is very susceptible to radiated RF-fields in the range 80 MHz to 1000 MHz. This is due to the fact that the Interrogator II is principally a broadband receiver. Any disturbance field in this frequency range is visible on the Interrogator II screen as moiré or inhibits a working display completely. This lack of susceptibility cannot be reduced without affecting the functionality of the interrogator II.



CONCLUSION

During testing the product sample was found **IN COMPLIANCE** with the following standards or part of standards:

Standard:	EN 50082-2:1995	harmonized
	EN 50081-2:1993	harmonized

During testing of the product failed to comply with the following standards or part of standards:

Emission limits of EN 50081-2:1993

After the stated modifications laid out in this report have been carried out the following applies:

The equipment under test complied to the requirements of the tests as layed down in this test report.

The results of the type-tests as stated in this report, are exclusively applicable to the product sample as identified in this test report. **ce-test** does not accept any liability for the results stated in this report, with respect to the properties for product items not involved in these tests.

This report consists of a main module and several test modules. All pages have been numbered consecutively and bear the **ce-test** logo, the report number and date.

The total number of pages in this test report is 19.

The above conclusions have been verified by the following signatory:

Date	3-7-01
Name	Ing. G. Gremmen
Function	Manager
Signature

TEST REPORT EMC***Emission of Radiated RF-energy***

Purpose of testing CE-marking
Directive used EMC-directive (89/336/EEC)

Standard used: EN 50081-2:1993
Basic standard CISPR 22

Class Industrial

Test description Emission of radiated RF-power
Applied to Representative operating situation

Test Distance 10 meters

Limits 40 dBuV/m between 30 and 230 MHz
47 dBuV/m between 230 and 1000 Mhz
(10 dB conversion between 10-30 meters assumed)

Equipment used Chase CLB6111A antenna
R&S ESV measuring receiver

Test setup Conform CISPR 16

Tolerance: Inaccuracy +/- 4dB

Measuring receiver	1
Antenna calibration	1
Read-out	0,5
Cable losses	1,5
Total	4

Frequency inaccuracy 1% FS
Conditions --

Deviations of standard No OATS used
Test were executed on real life operating situation:
Sand soil covered with standard paves
Location : Kiotoweg Rotterdam NW
Due to the absence of a reflective ground plane a 6 dB
margin was added to the measuring results.

Remarks GPR System type INTERROGATOR II

Device Under Test (DUT):

External hardware (CE-marked).
none

External hardware (not CE-marked)
none

MEASURING RESULTS:

The EUT was placed on a distance of 10 meters from the antenna (see picture) The measurement values were corrected for antenna factor, cable losses and other inaccuracies. The Standards limits were corrected with - 6dB for the absence of a reflecting ground plane.

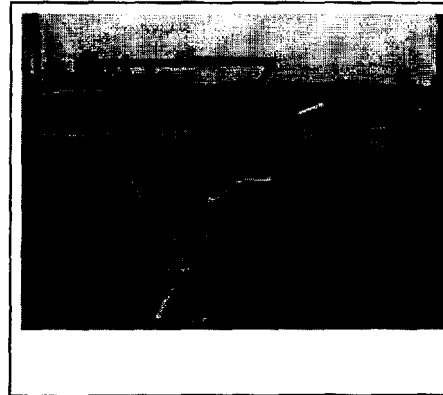
Measuring Distance		10 meter		EUT right side	
Polarization		Horizontal			
Mhz	dBuV	AF	Corr.	dBuV/m	Industr limi
53,3	11	7	4	22	34
74,8	11	6,8	4	21,8	34
82	12	7,3	4	23,3	34
113	12	11	4	27	34
120	12	12	4	28	34
162,27	12	10,4	4	26,4	34
182	10	9	4	23	34
227	12	11	4	27	34
244,73	13	12,5	4	29,5	41
Front side					
60	12	6	4	22	34
110	12	11	4	27	34
Back side					
120	12	12	4	28	34
164	12	10	4	26	34
189,3	12	9	4	25	34



All emission components are broadband emissions, and the noted frequencies are measured on the top of wide band spectrum lobes. As the repetition frequency of the Interrogator is 200 KHz , emission spectrum lines are separated 200 KHz only.

The spectrum measured at vertical antenna polarization and miscellaneous orientations of the EUT.

Measuring Distance 10 meter EUT right side					
Polarization Vertical					
Mhz	dBuV	AF	Corr.	dBuV/m	Industr limi
63	15	6,2	4	25,2	34
76	13	6,8	4	23,8	34
120	11	12	4	27	34
150	10	11	4	25	34
155	13	10,5	4	27,5	34
228	10	12	4	26	34
258	10	14	4	28	41
293	10	13,5	4	27,5	41
Left side					
45	14	10	4	28	34
Back side					
54	16		4	20	34
85	14	6,3	4	24,3	34
111	14	11	4	29	34
114	18	11,3	4	33,3	34
141	12	11,5	4	27,5	34
180	16	9	4	29	34
225	11	9,5	4	24,5	34
244	13	12,6	4	29,6	41
263	14	12,2	4	30,2	41
313	12	14	4	30	41



Conclusion Emission of Radiated RF-energy

De EUT is compliant with the applied standards.

TEST REPORT EMC***Immunity to RF Electromagnetic field***

Purpose of this test	CE-marking.
Directive's used	EMC-directive (89/336/EEC)
Standard used	EN 50082-2:1995
Basic standard	EN 61000-3-3
Performance class	A
Manufacturers degradation	Accuracy better then 5%
Test description	Immunity to RF-Electro-Magnetic field
Test applied to	Operational set up of the product.
Mains specification	NA
Frequency range	80 MHz to 1000 MHz.
Equipment used:	R&S SMY-01 Kalmus 10 W amplifier Chase CLB6111 antenna
Location	CHAM delft.
Test setup	ACC. EN 61000-3-3
Differences to standard	Modulated field 80% AM / 1 kHz.
Field amplitude	10 V/m
Tolerance	Amplitude 6 dB.
Frequency inaccuracy	10 PPM
Conditions	Antenna / EUT distance 1 m.
External hardware	(ce-marked) none
External hardware	(not ce-marked) none
Remark	none
Cable setup:	

TEST RESULTS

Immunity to RF-Electro-Magnetic field

The frequency range 80-1000 MHz is tested in steps with increasing frequency of 1% per step . At every frequency the field amplitude is adjusted using a calibration table.
Frequency range : 80 MHz -- 1000 MHz In addition to the stepwise testing a full gliding scan has been performed making sure the field amplitude never gets lower then the test limit.

The Interrogator is very susceptible to radiated RF-fields in the range 80 MHz to 1000 MHz. This is due to the fact that the Interrogator II is principally a broadband receiver. Any disturbance field above 100 mV / meter in both polarazations in this frequency range is visable on the Interrogator II screen as moiré or makes the image useless.

As the function of the Interrogator II is essentially that of a broadband receiver, specifying functional limits at 10 V/meter is impossible. This test is therefore not applicable/suitable to the type of equipment.

Conclusion Emission of Radiated RF-energy

De EUT is compliant with the applied standards.

TEST REPORT EMC***Electro Static Discharge test***

Purpose of testing	CE-marking
Directive used	EMC-directive (89/336/EEC)
Standard used	EN 50082-2:1995
Basic standard	EN 61000-4-2.
Test description	Electro Static Discharge test
Performance class	Class B
Mains specification	NA
Applied to	Metal parts accessible (contact discharge) Approaching method (device excluding cables) Approaching method (HCP and VCP)
Equipment used	Keytek ce-master:
Test set up	ACC. to IEC 1000-4-2 conform
Tolerance Pulse shape	+/- 10% Amplitude + 10%
Conditions	
Deviations from standard	equipment placed on wooden pallet approx 10 cm high.
External hardware	(ce-marked) none
External hardware	(not ce-marked) none

TEST RESULTS

Electro Static Discharge test

EUT operating.

While approaching EUT miscellaneous sides of the EUT are directed.

10 Air discharges of 8 kV in either polarity on EUT.

Air discharges on plastic enclosure are not possible.

Air discharges are done on metal frame : points left and right.

Discharges were made on metal fram points left and right and on the enclosure of the touchbook notebook.

Result:

The EUT does not go into permanent failure as mend in the stated criterion type B.

No discharges were made on the connector pins.

10 Air discharges of 8 kV in either polarity on VCP and HCP (total 40 discharges)

Result:

The EUT does not go into permanent failure as mend in the stated criterion type B.

10 contact discharges at 4 kV in either polarity to accessible metal parts.

Contact discharges on plastic enclosures are not possible.

Discharges were made on metal fram points left and right and on the enclosure of the touchbook notebook.

Result:

The EUT does not go into permanent failure as mend in the stated criterion type B.

10 contact discharges of 4 kV in either polarity on VCP and HCP (total 40 discharges)

RESULT:

The EUT does not go into permanent failure as mend in the stated criterion type B.

Remarks: Before starting the tests sensible areas were scanned using a 20 discharge per second rate.
No sensible points were detected, therefore the above tests on the metal frame are pro forma only.



Appendix I

Measurement results for a total of 0 pages.

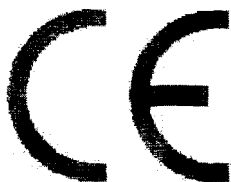
Appendix II

Customer documentation according to the following table:

Description	Date	Identification	Sheets
Operator manual	3-2000	o1_00	114 odd
Specification sheet	none	none	2LETTER

END OF TEST REPORT

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010113/INTII/EMC

We,

Vermeer International BV

(Supplier's name)

Postbus 323
4458 AV 's-Heer Arendskerke
The Netherlands

(supplier's address)

declare under our sole responsibility that the product:

This declaration of
Conformity is suitable
to the European
Standard
EN 45014 General
Criteria for supplier's
Declaration of
Conformity. The basis
for the criteria has
been found in
international
documentation,
particularly in
ISO/IEC, Guide 22,
1982, Information on
manufacturer's
Declaration of
Conformity with
standards or other
technical
specifications

GPR System type INTERROGATOR II

Name, type or model, batch or serial number, possibly source and number of items.

to which this declaration relates in conformity with the following European, harmonized
and published standards at date of this declaration:

Standard: EN 50082-2:1995 harmonized
EN 50081-2:1993 harmonized

Title and or number and date of issue of the applied standard(s)

following the provisions of the Directives (if applicable):

EMC-directive : 89/336/EEC

Amendment to the above directive: 93/68/EEC

These conclusions are based on test reports:

010113/INTII/EMC

ce-test PO box 563 2600 AN Delft

test report number, date and name of test house

's-Heer Arendskerke,

Place and date of issue

P.J. Sturm

name of responsible for CE-marking

jul 0107-03-01

